

## CLAIMS

1. A process for the preparation of a composition of nanoparticles of at least one crystalline metal oxide from at least one organometallic precursor, in which process:
  - there is(are) selected (a) precursor(s) that is(are) spontaneously reactive to oxidation,
  - a liquid solution of the precursor(s) in a non-aqueous solvent medium is produced,
  - the liquid solution is brought into contact with at least one oxidizing agent under reaction conditions suitable for bringing about directly the production of nanoparticles of crystalline metal oxide(s).
2. The process as claimed in claim 1, wherein the solvent medium comprises at least one compound, called a ligand, selected from the bases and acids.
3. The process as claimed in claim 2, wherein there is chosen at least one ligand that is not volatile at the reaction temperature and that acts as dispersing agent for the composition produced in the solvent medium.
4. The process as claimed in either claim 2 or claim 3, wherein an aliphatic organic compound is used as ligand.
5. The process as claimed in claim 4, wherein there is used as ligand an organic compound containing an unbranched aliphatic chain having from 6 to 20 carbon atoms.
6. The process as claimed in any one of claims 2 to 5, wherein there is used at least one ligand selected from the group of the amines, acids, thiols, phosphorus derivatives and ethers.

7. The process as claimed in claim 6, wherein there is used at least one ligand selected from the group comprising hexadecylamine, dodecylamine, octylamine, dodecylthiol, octanoic acid, oleic acid, lauric acid.
- 5 8. The process as claimed in any one of claims 2 to 7, wherein at least one base and at least one acid are chosen as ligands.
9. The process as claimed in any one of claims 1 to 8, wherein said solvent medium comprises at least two separate compounds.
- 10 10. The process as claimed in claims 2 and 9, wherein said solvent medium comprises at least one ligand and at least one compound that is volatile under the reaction conditions and gradually evaporates during the oxidation.
- 15 11. The process as claimed in claim 10, wherein said solvent medium is formed of THF and an aliphatic primary amine.
12. The process as claimed in any one of claims 1 to 11, wherein the oxidation is carried out at ambient pressure and at a temperature of from 0°C to 200°C, especially at ambient temperature.
- 20 13. The process as claimed in any one of claims 1 to 12, wherein there is used at least one oxidizing agent selected from dioxygen, water vapour, organic oxidizing agent, other non-organic oxidizing agents.
- 25 14. The process as claimed in any one of claims 1 to 13, wherein the oxidation is carried out without stirring the liquid solution.
15. The process as claimed in any one of claims 1 to 14, wherein said solvent medium is non-alcoholic.

16. The process as claimed in any one of claims 1 to 15, wherein, for the preparation of nanoparticles of crystalline zinc oxide, zinc dicyclohexyl  $Zn(C_6H_{11})_2$  is chosen as precursor.
- 5 17. The process as claimed in any one of claims 1 to 16, wherein, for the preparation of nanoparticles of tin oxide, a precursor is selected from tin bis(bis(dimethylamide))  $[Sn(N(CH_3)_2)_2]_2$  and tin dicyclopentadienyl  $Sn(C_5H_5)_2$ .
- 10 18. The process as claimed in any one of claims 1 to 17, wherein, for the preparation of indium oxide, indium cyclopentadienyl  $In(C_5H_5)_2$  is chosen as precursor.
- 15 19. The process as claimed in any one of claims 1 to 18, wherein, for the preparation of a mixed metal oxide, at least two separate precursors are chosen from the group formed of zinc dicyclohexyl  $Zn(C_6H_{11})_2$ , tin bis(bis(dimethylamide))  $[Sn(N(CH_3)_2)_2]_2$ , tin dicyclopentadienyl  $Sn(C_5H_5)_2$ , indium cyclopentadienyl  $In(C_5H_5)_2$ .
- 20 20. A composition of nanoparticles of at least one crystalline metal oxide in the form of a colloidal liquid solution and having forms and dimensions corresponding to a unimodal distribution.
- 25 21. The composition as claimed in claim 20, wherein the nanoparticles have form anisotropy.
22. The composition as claimed in either claim 20 or claim 21, wherein the nanoparticles have an elongated form with an average width of less than 50 nm and an average length of greater than twice the average width.

23. The composition as claimed in claim 22, wherein the nanoparticles have an average width of from 2 nm to 7 nm and an average length of from 10 nm to 20 nm.
- 5 24. The composition as claimed in any one of claims 20 to 23, which composition is composed of nanoparticles of crystalline zinc oxide having a hexagonal structure free of crystalline hydroxide.